FIG. 1A

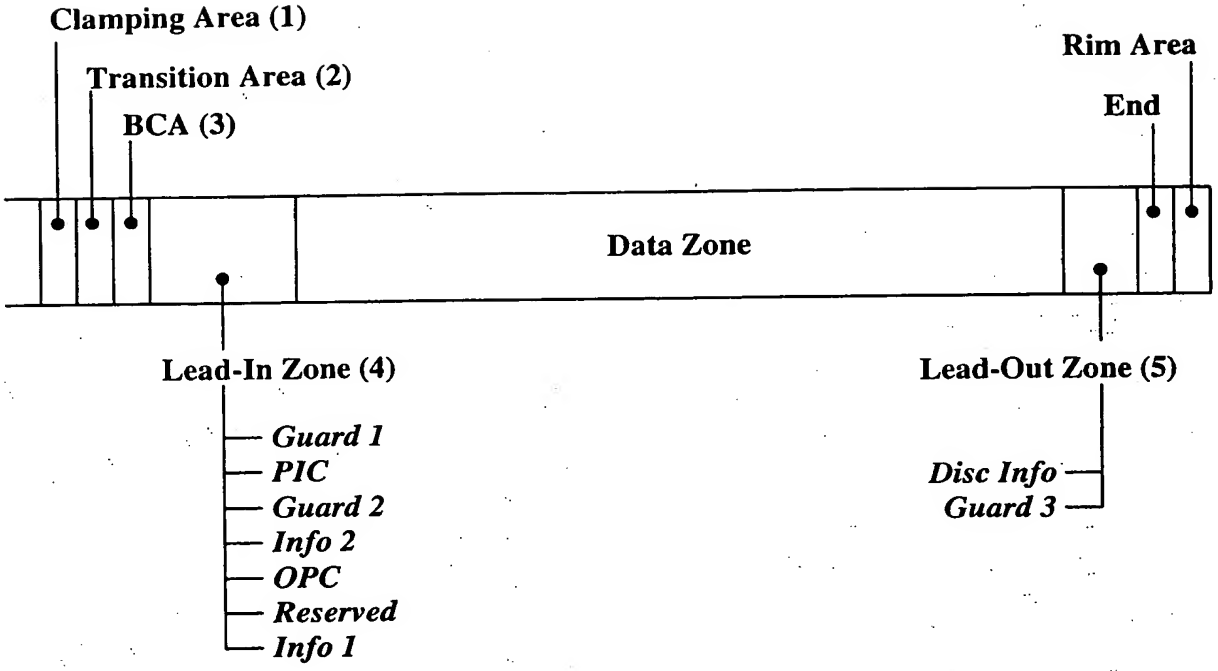
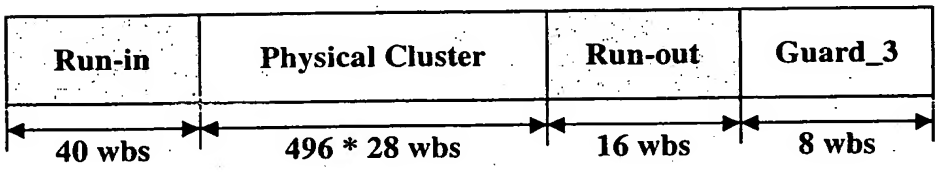
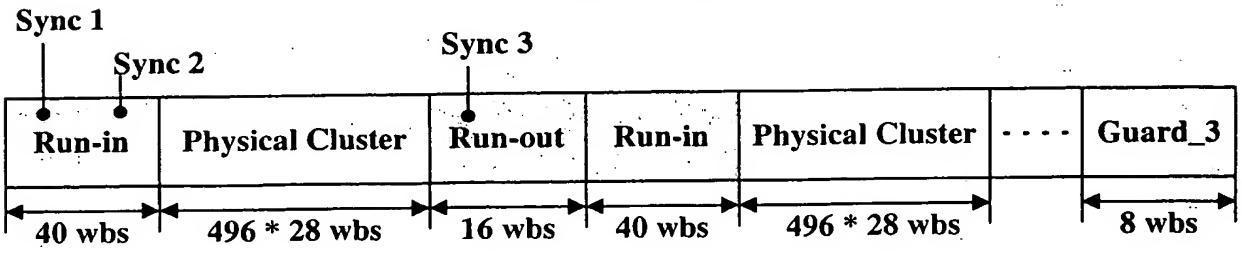


FIG. 1B



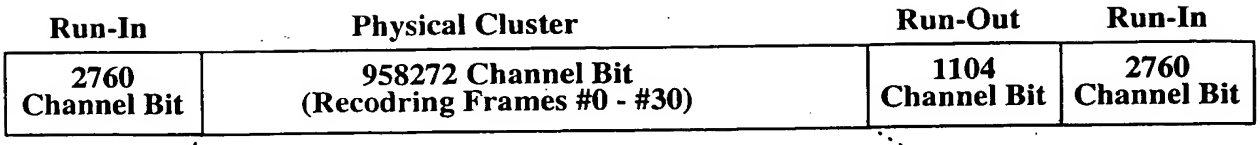
Single written Recording Unit Block (RUB)

FIG. 1C



Continuously written sequence of Recording Unit Blocks

FIG. 1D



Frame Number	Frame Sync	Frame Number	Frame Sync
Frame #0	FS 0	Frame #16	FS 5
Frame #1	FS 1	Frame #17	FS 3
Frame #2	FS 2	Frame #18	FS 2
Frame #3	FS 3	Frame #19	FS 2
Frame #4	FS 3	Frame #20	FS 5
Frame #5	FS 1	Frame #21	FS 6
Frame #6	FS 4	Frame #22	FS 5
Frame #7	FS 1	Frame #23	FS 1
Frame #8	FS 5	Frame #24	FS 1
Frame #9	FS 5	Frame #25	FS 6
Frame #10	FS 4	Frame #26	FS 2
Frame #11	FS 3	Frame #27	FS 6
Frame #12	FS 4	Frame #28	FS 4
Frame #13	FS 6	Frame #29	FS 4
Frame #14	FS 6	Frame #30	FS 2
Frame #15	FS 3		

FIG. 1E

Sync Number	24-bit sync body	6-bit sync ID
FS 0	01 010 000 000 010 000 000 010	000 001
FS 1	01 010 000 000 010 000 000 010	010 010
FS 2	01 010 000 000 010 000 000 010	101 000
FS 3	01 010 000 000 010 000 000 010	100 001
FS 4	01 010 000 000 010 000 000 010	000 100
FS 5	01 010 000 000 010 000 000 010	001 001
FS 6	01 010 000 000 010 000 000 010	010 000

FIG. 2A

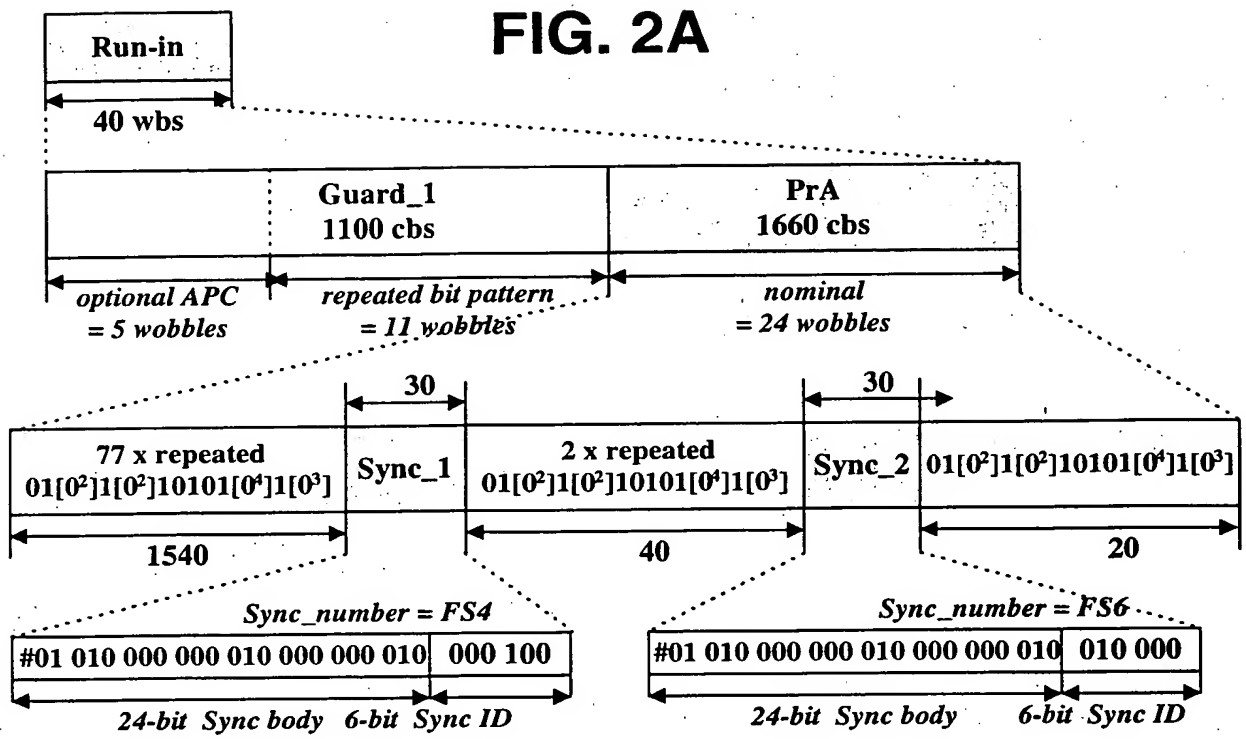

Run-in
40 wbs
Guard_1
1100 cbs
PrA
1660 cbs
optional APC
= 5 wobbles
repeated bit pattern
= 11 wobbles
nominal
= 24 wobbles
30
30
77 x repeated
01[0²]1[0²]10101[0⁴]1[0³]
Sync_1
2 x repeated
01[0²]1[0²]10101[0⁴]1[0³]
Sync_2
01[0²]1[0²]10101[0⁴]1[0³]
1540
40
20
Sync_number = FS4
#01 010 000 000 010 000 000 010
000 100
24-bit Sync body
6-bit Sync ID
Sync_number = FS6
#01 010 000 000 010 000 000 010
010 000
24-bit Sync body
6-bit Sync ID

FIG. 2B

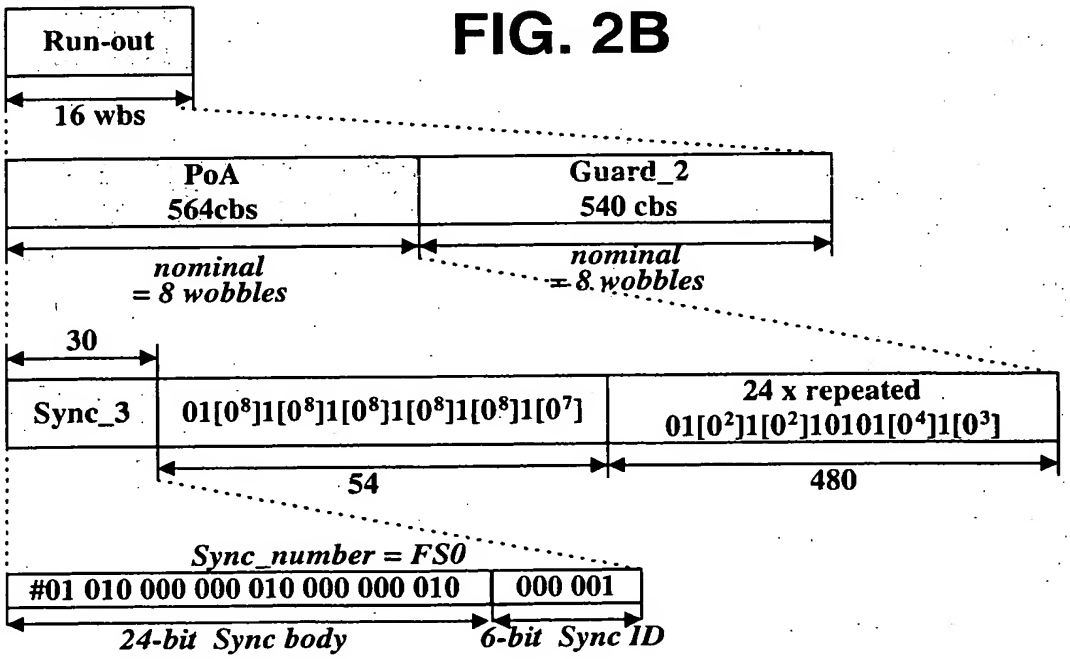

Run-out
16 wbs
PoA
564cbs
Guard_2
540 cbs
nominal
= 8 wobbles
nominal
= 8 wobbles
30
Sync_3
01[0⁸]1[0⁸]1[0⁸]1[0⁸]1[0⁸]1[0⁷]
24 x repeated
01[0²]1[0²]10101[0⁴]1[0³]
54
480
Sync_number = FS0
#01 010 000 000 010 000 000 010
000 001
24-bit Sync body
6-bit Sync ID

FIG. 3A

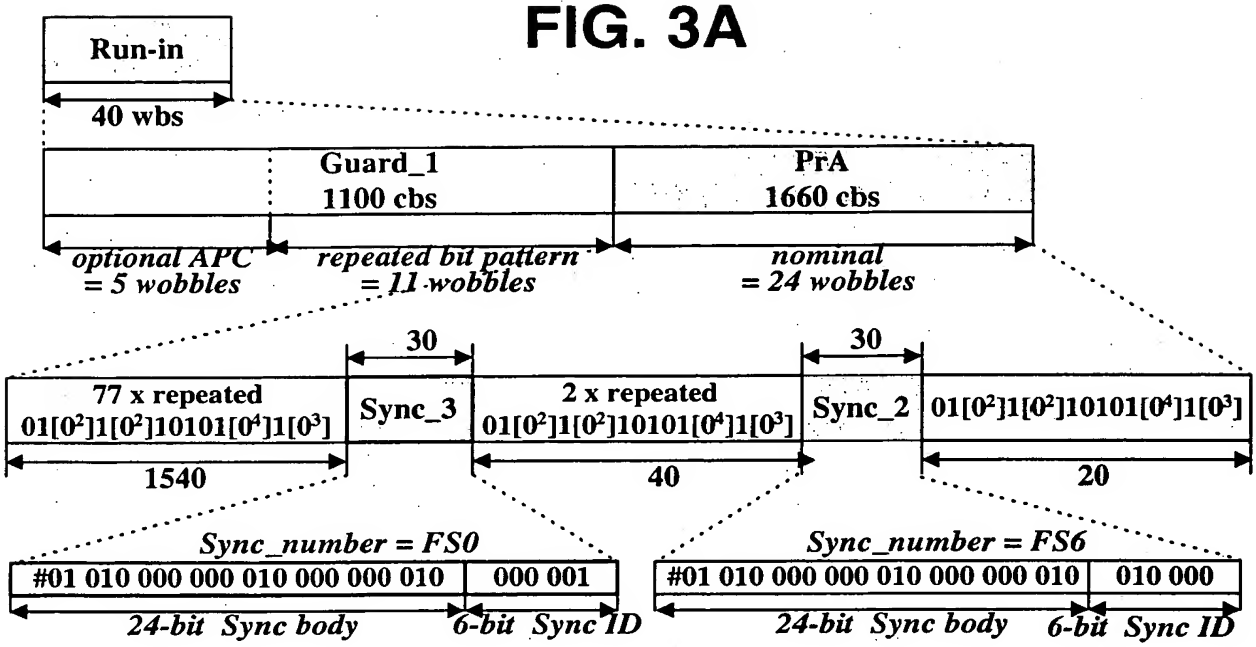

Run-in
40 wbs
Guard_1
1100 cbs
PrA
1660 cbs
optional APC
= 5 wobbles
repeated bit pattern
= 11 wobbles
nominal
= 24 wobbles
30
30
77 x repeated
01[0²]1[0²]10101[0⁴]1[0³]
Sync_3
2 x repeated
01[0²]1[0²]10101[0⁴]1[0³]
Sync_2
01[0²]1[0²]10101[0⁴]1[0³]
1540
40
20
Sync_number = FS0
#01 010 000 000 010 000 000 010
000 001
24-bit Sync body
6-bit Sync ID
Sync_number = FS6
#01 010 000 000 010 000 000 010
010 000
24-bit Sync body
6-bit Sync ID

FIG. 3B

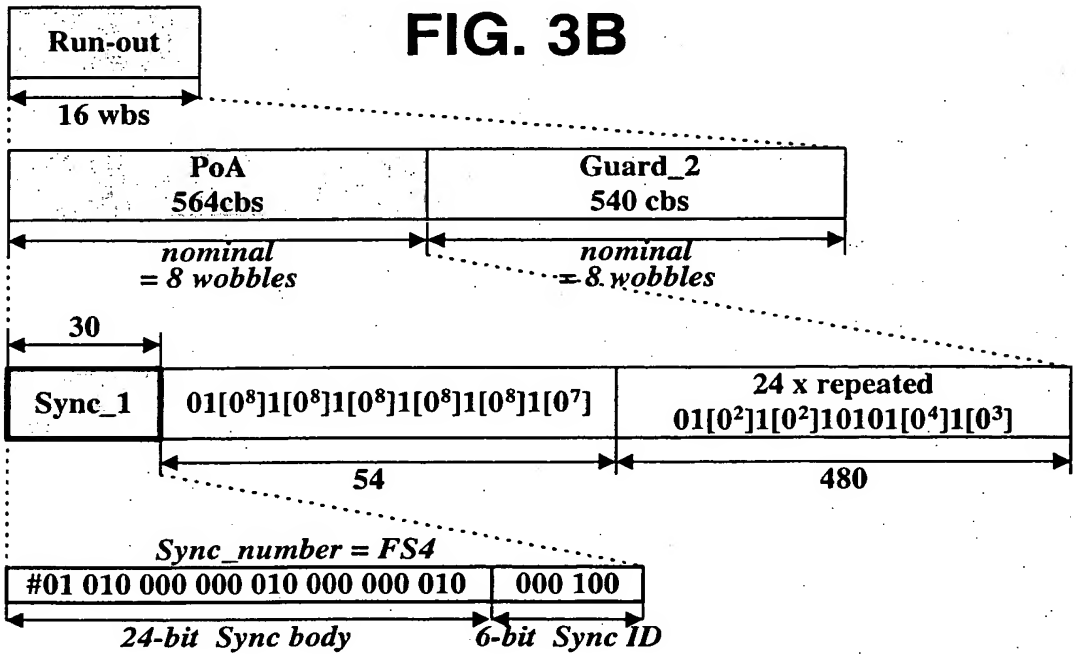

Run-out
16 wbs
PoA
564cbs
Guard_2
540 cbs
nominal
= 8 wobbles
nominal
= 8 wobbles
30
Sync_1
01[0⁸]1[0⁸]1[0⁸]1[0⁸]1[0⁸]1[0⁷]
24 x repeated
01[0²]1[0²]10101[0⁴]1[0³]
54
480
Sync_number = FS4
#01 010 000 000 010 000 000 010
000 100
24-bit Sync body
6-bit Sync ID

FIG. 4A

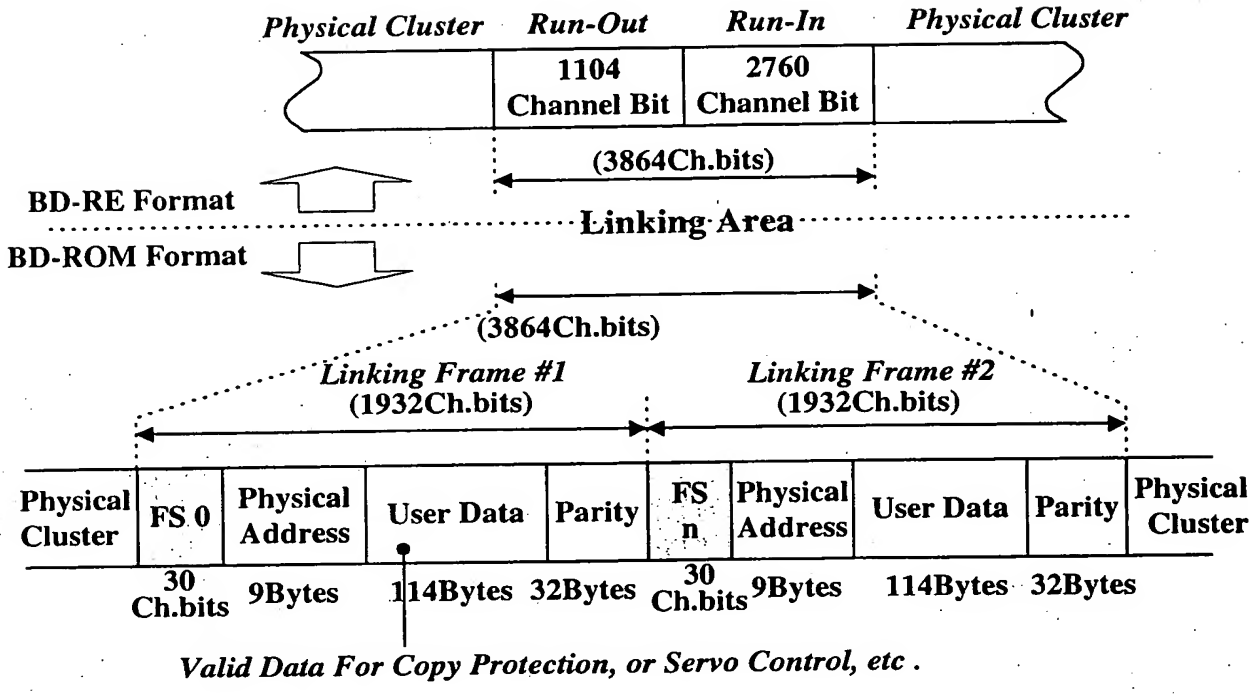

Physical Cluster
Run-Out
Run-In
Physical Cluster
1104 Channel Bit
2760 Channel Bit
(3864Ch.bits)
BD-RE Format
Linking Area
BD-ROM Format
(3864Ch.bits)
Linking Frame #1 (1932Ch.bits)
Linking Frame #2 (1932Ch.bits)
Physical Cluster
FS 0
Physical Address
User Data
Parity
FS n
Physical Address
User Data
Parity
Physical Cluster
30 Ch.bits
9Bytes
114Bytes
32Bytes
30 Ch.bits
9Bytes
114Bytes
32Bytes
Valid Data For Copy Protection, or Servo Control, etc .

FIG. 4B

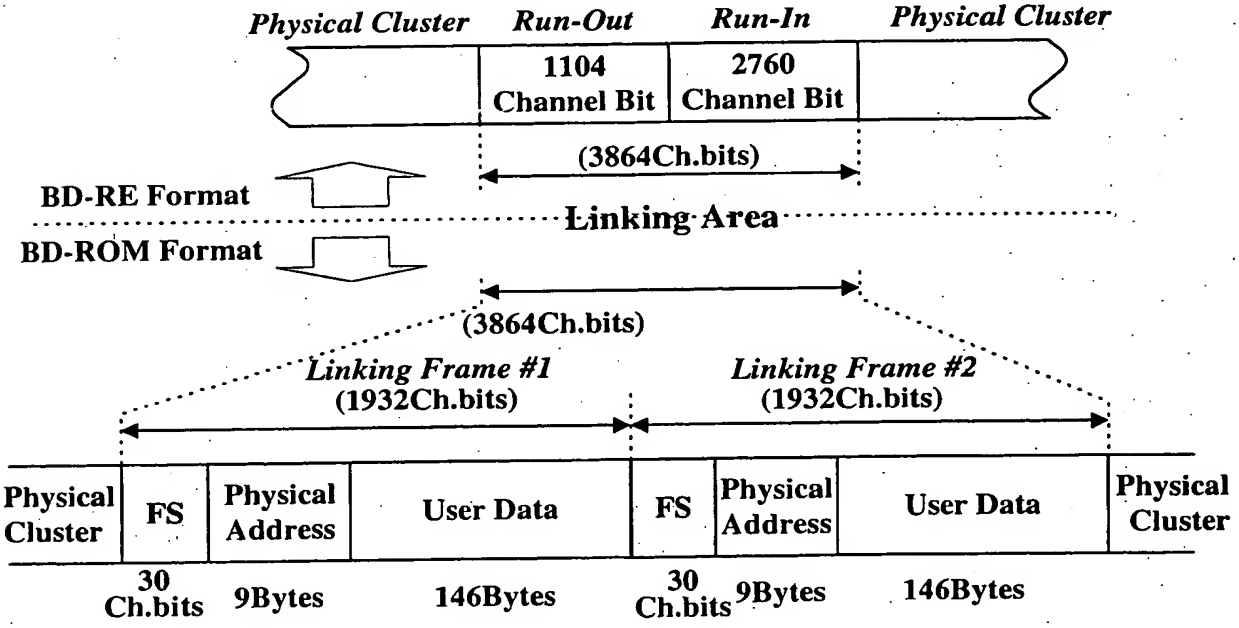

Physical Cluster
Run-Out
Run-In
Physical Cluster
1104 Channel Bit
2760 Channel Bit
(3864Ch.bits)
BD-RE Format
Linking Area
BD-ROM Format
(3864Ch.bits)
Linking Frame #1 (1932Ch.bits)
Linking Frame #2 (1932Ch.bits)
Physical Cluster
FS
Physical Address
User Data
FS
Physical Address
User Data
Physical Cluster
30 Ch.bits
9Bytes
146Bytes
30 Ch.bits
9Bytes
146Bytes

FIG. 4C

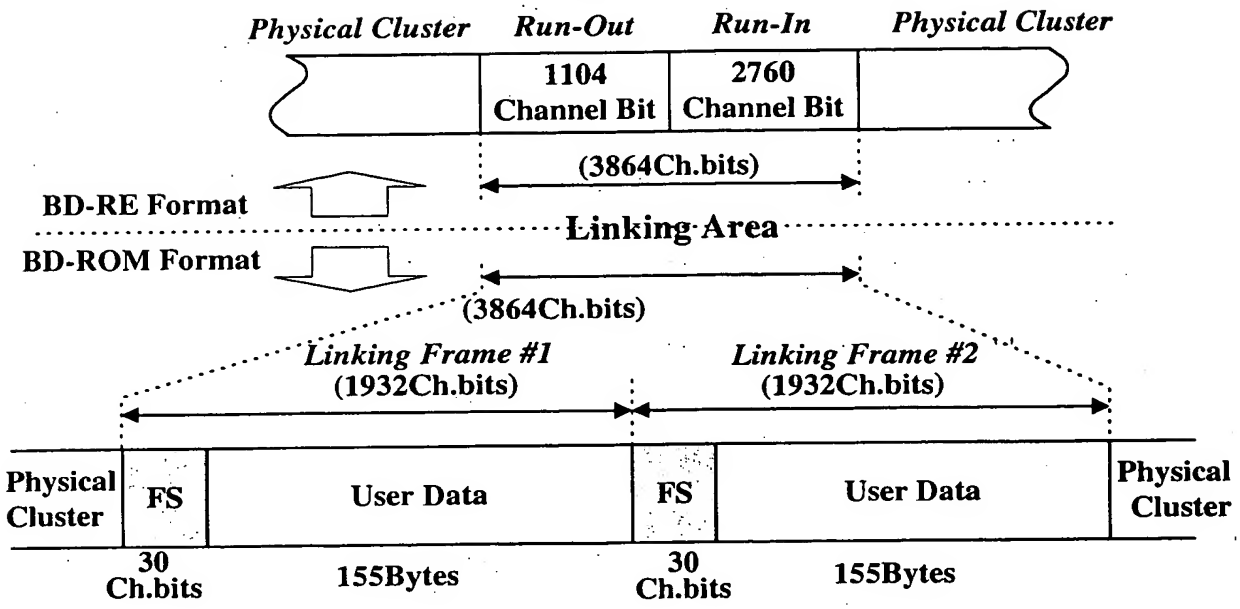

Physical Cluster
Run-Out
Run-In
Physical Cluster
1104 Channel Bit
2760 Channel Bit
(3864Ch.bits)
BD-RE Format
Linking Area
BD-ROM Format
(3864Ch.bits)
Linking Frame #1 (1932Ch.bits)
Linking Frame #2 (1932Ch.bits)
Physical Cluster
FS
User Data
FS
User Data
Physical Cluster
30 Ch.bits
155Bytes
30 Ch.bits
155Bytes

FIG. 4D

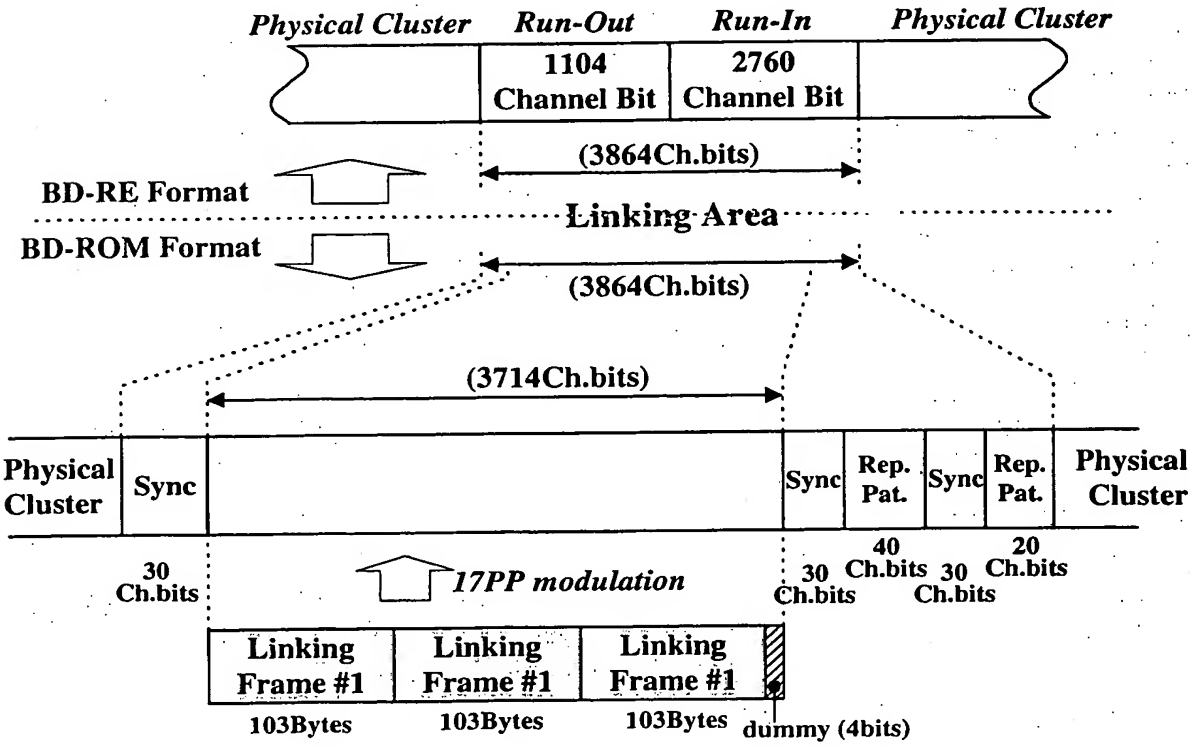

Physical Cluster
Run-Out
Run-In
Physical Cluster
1104 Channel Bit
2760 Channel Bit
(3864Ch.bits)
BD-RE Format
Linking Area
BD-ROM Format
(3864Ch.bits)
(3714Ch.bits)
Physical Cluster
Sync
Sync
Rep. Pat.
Sync
Rep. Pat.
Physical Cluster
30 Ch.bits
17PP modulation
30 Ch.bits
40 Ch.bits
30 Ch.bits
20 Ch.bits
Linking Frame #1
Linking Frame #1
Linking Frame #1
103Bytes
103Bytes
103Bytes
dummy (4bits)

FIG. 5

FS n (new)	01 010 000 000 010 000 000 010	*FS 7 : 100 101* *FS 8 : 101 010* *FS 9 : 010 101* *FS 10: 101 001*

FIG. 6A

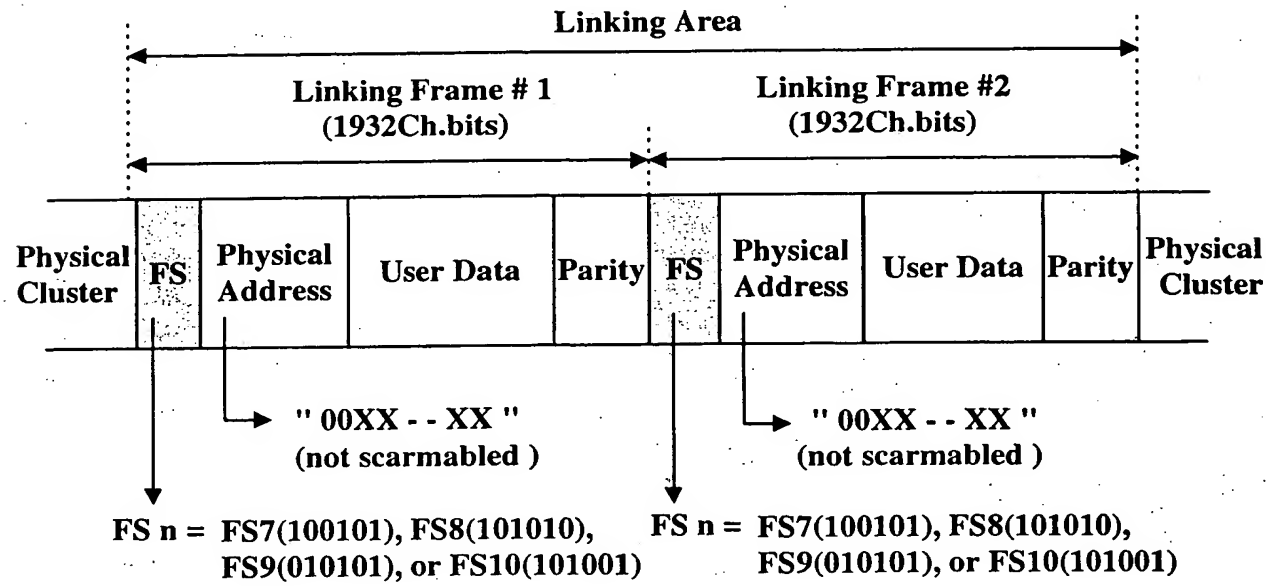


FIG. 6B

	Case 1	Case 2	Case 3	Case 4
FS #1	FS0	FS0	FS7, 8, or 9	FS10
FS #2	FS7	FS10	FS7, 8, or 9	FS10

FIG. 7A

Sync 1 : FS0, Sync 2 : FS7

Frame n	Frame n-1	Frame n-2	Frame n-3	Frame Number	
FS0	FS7	FS0	FS2	0	(1)
FS0	FS2	FS4	FS4	0	(2)
FS0	FS2	FS4	FS4	31	
FS1	FS0	FS7/FS2	FS0/FS4	1	(3)
FS1	FS3	FS3	FS2	5	
FS1	FS4	FS1	FS3	7	
FS1	FS5	FS6	FS5	23	
FS1	FS1	FS5	FS6	24	
FS2	FS1	FS0	FS7/FS2	2	(4)
FS2	FS3	FS5	FS3	18	
FS2	FS2	FS3	FS5	19	
FS2	FS6	FS1	FS1	26	
FS2	FS4	FS4	FS6	30	
FS3	FS2	FS1	FS0	3	
FS3	FS3	FS2	FS1	4	
FS3	FS4	FS5	FS5	11	
FS3	FS6	FS6	FS4	15	
FS3	FS5	FS3	FS6	17	
FS4	FS1	FS3	FS3	6	
FS4	FS5	FS5	FS1	10	
FS4	FS3	FS4	FS5	12	
FS4	FS6	FS2	FS6	28	
FS4	FS5	FS3	FS6	29	
FS5	FS1	FS4	FS1	8	
FS5	FS5	FS1	FS4	9	
FS5	FS3	FS6	FS6	26	
FS5	FS2	FS2	FS3	20	
FS5	FS6	FS5	FS2	22	
FS6	FS4	FS3	FS4	13	
FS6	FS6	FS4	FS3	14	
FS6	FS5	FS2	FS2	21	
FS6	FS1	FS1	FS5	25	
FS6	FS2	FS6	FS1	27	
FS7	FS0	2	FS4	32	

A

(1) : Frame Number 0 for the 1st AUN(Address Unit) of RUB
(2) : Frame Number 0 for the the Middle AUN(Address Unit) of RUB
(3) : Frame Number 1 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)
(4) : Frame Number 2 (1st AUN(Address Unit of RUB / Middle AUN(Address Unit) of RUB)

FIG. 7B

Sync 1 : FS7, Sync 2 : FS7

Frame n	Frame n-1	Frame n-2	Frame n-3	Frame Number	
FS0	FS7/FS2	FS7/FS4	FS2/FS4	0	→ (1)
FS1	FS0	FS7/FS2	FS7/FS4	1	→ (2)
FS1	FS3	FS3	FS2	5	
FS1	FS4	FS1	FS3	7	
FS1	FS5	FS6	FS5	23	
FS1	FS1	FS5	FS6	24	
FS2	FS1	FS0	FS7/FS2	2	→ (3)
FS2	FS3	FS5	FS3	18	
FS2	FS2	FS3	FS5	19	
FS2	FS6	FS1	FS1	26	
FS2	FS4	FS4	FS6	30	
FS3	FS2	FS1	FS0	3	
FS3	FS3	FS2	FS1	4	
FS3	FS4	FS5	FS5	11	
FS3	FS6	FS6	FS4	15	
FS3	FS5	FS3	FS6	17	
FS4	FS1	FS3	FS3	6	
FS4	FS5	FS5	FS1	10	
FS4	FS3	FS4	FS5	12	
FS4	FS6	FS2	FS6	28	
FS4	FS5	FS3	FS6	29	
FS5	FS1	FS4	FS1	8	
FS5	FS5	FS1	FS4	9	
FS5	FS3	FS6	FS6	26	
FS5	FS2	FS2	FS3	20	
FS5	FS6	FS5	FS2	22	
FS6	FS4	FS3	FS4	13	
FS6	FS6	FS4	FS3	14	
FS6	FS5	FS2	FS2	21	
FS6	FS1	FS1	FS5	25	B
FS6	FS2	FS6	FS1	27	
FS7	FS2	FS4	FS4	31	
FS7	FS7	FS2	FS4	32	

(1) : Frame Number 0 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)
(2) : Frame Number 1 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)
(3) : Frame Number 2 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)

FIG. 7C

Sync 1 : FS7, Sync 2 : FS8

Frame n	Frame n-1	Frame n-2	Frame n-3	Frame Number	
FS0	FS8/FS2	FS7/FS4	FS2/FS4	0	(1)
FS1	FS0	FS8/FS2	FS7/FS4	1	(2)
FS1	FS3	FS3	FS2	5	
FS1	FS4	FS1	FS3	7	
FS1	FS5	FS6	FS5	23	
FS1	FS1	FS5	FS6	24	
FS2	FS1	FS0	FS7/FS2	2	(3)
FS2	FS3	FS5	FS3	18	
FS2	FS2	FS3	FS5	19	
FS2	FS6	FS1	FS1	26	
FS2	FS4	FS4	FS6	30	
FS3	FS2	FS1	FS0	3	
FS3	FS3	FS2	FS1	4	
FS3	FS4	FS5	FS5	11	
FS3	FS6	FS6	FS4	15	
FS3	FS5	FS3	FS6	17	
FS4	FS1	FS3	FS3	6	
FS4	FS5	FS5	FS1	10	
FS4	FS3	FS4	FS5	12	
FS4	FS6	FS2	FS6	28	
FS4	FS5	FS3	FS6	29	
FS5	FS1	FS4	FS1	8	
FS5	FS5	FS1	FS4	9	
FS5	FS3	FS6	FS6	26	
FS5	FS2	FS2	FS3	20	
FS5	FS6	FS5	FS2	22	
FS6	FS4	FS3	FS4	13	
FS6	FS6	FS4	FS3	14	
FS6	FS5	FS2	FS2	21	
FS6	FS1	FS1	FS5	25	
FS6	FS2	FS6	FS1	27	
FS7	FS2	FS4	FS4	31	
FS8	FS7	FS2	FS4	32	

(1) : Frame Number 0 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)
(2) : Frame Number 1 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)
(3) : Frame Number 2 (1st AUN(Address Unit) of RUB / Middle AUN(Address Unit) of RUB)

FIG. 7D

17PP modulation code conversion table

data bits	modulation bits	
00 00 00 00	010 100 100 100	
00 00 10 00	000 100 100 100	
00 00 00	010 100 000	
00 00 01	010 100 100	
00 00 10	000 100 100	
00 00 11	000 100	
00 01	010 100	
00 10	010 000	
00 11	010 100	
01	010	
10	001	
11	000 101	if preceding modulation bits = xx1 if preceding modulation bits = xx0

FIG. 8

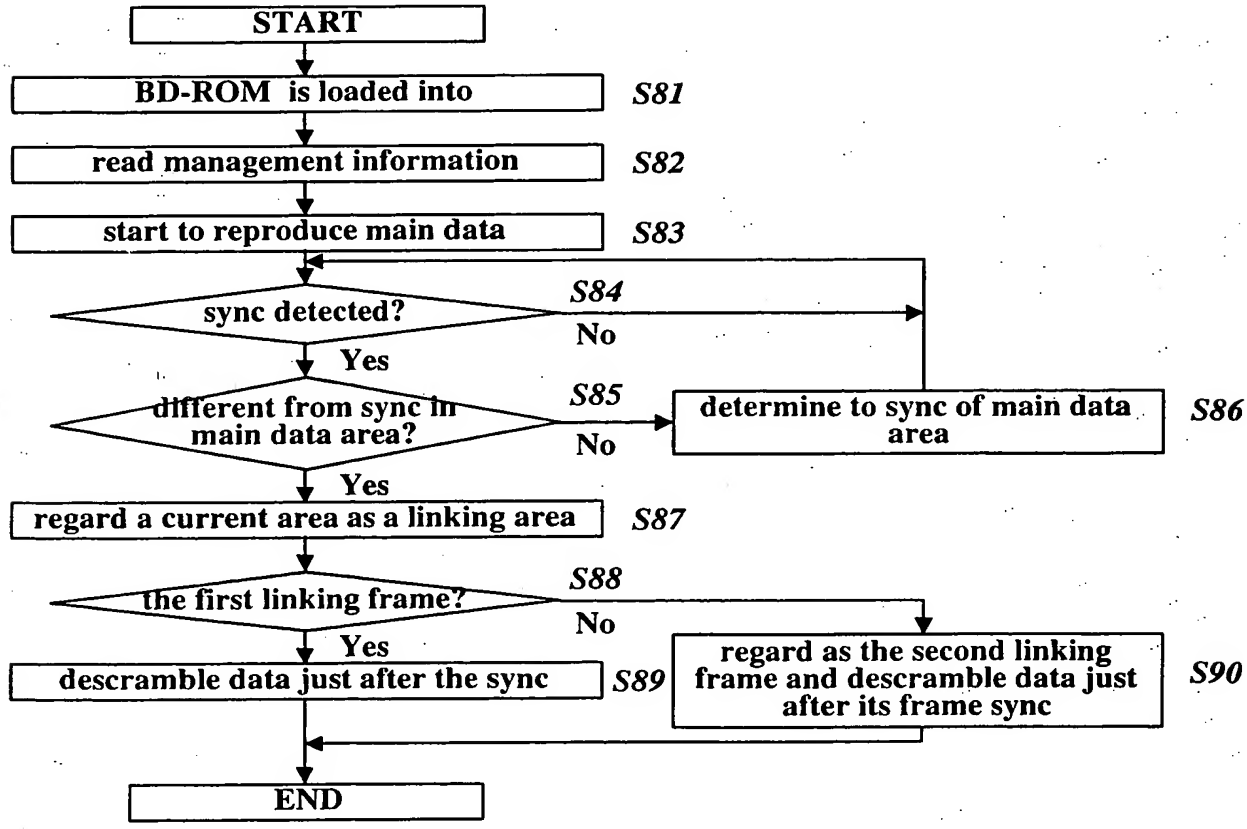


FIG. 9

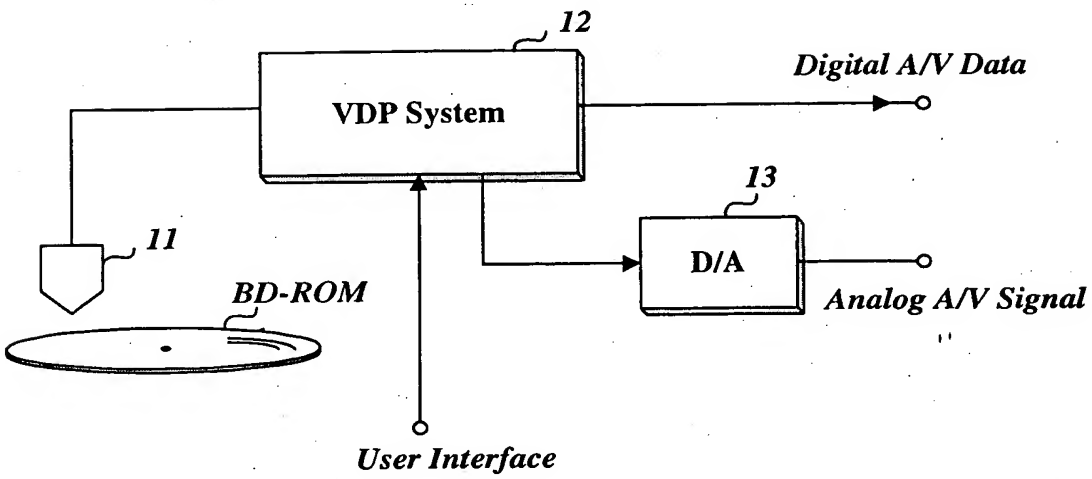

12
VDP System
Digital A/V Data
13
D/A
Analog A/V Signal
11
BD-ROM
User Interface

FIG. 10A

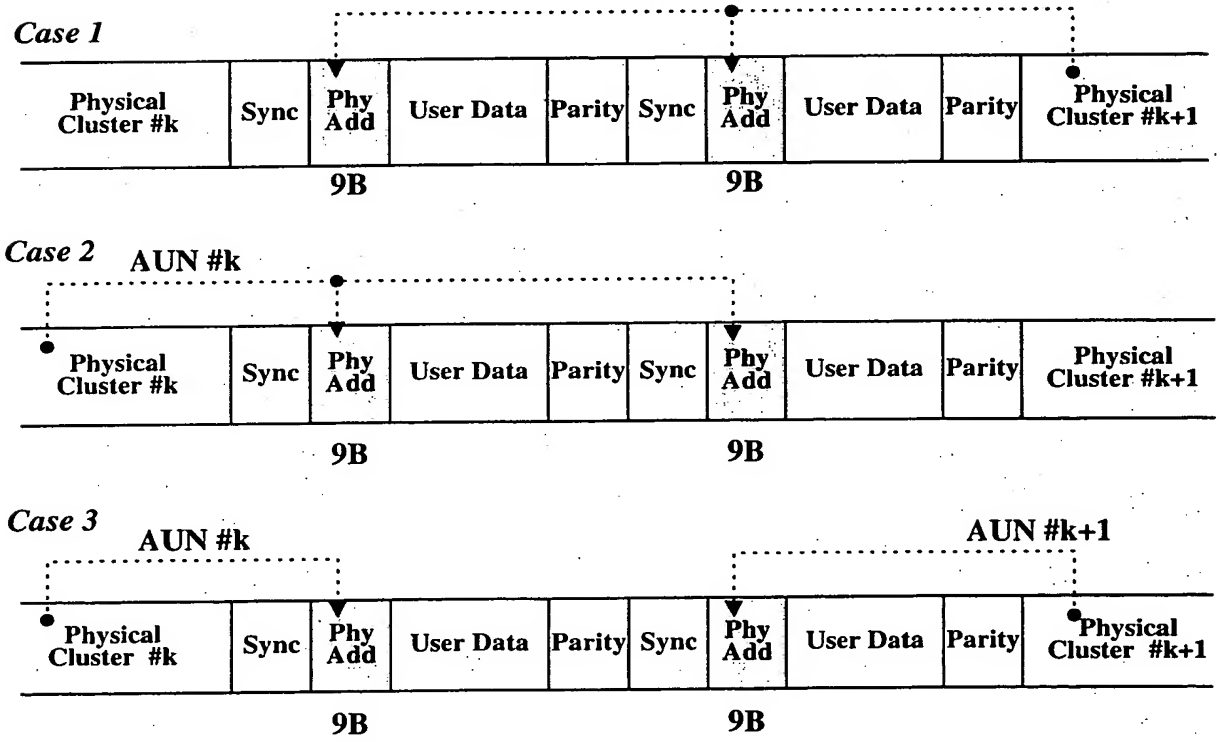

Case 1
Physical Cluster #k
Sync
Phy Add
User Data
Parity
Sync
Phy Add
User Data
Parity
Physical Cluster #k+1
9B
9B
Case 2
AUN #k
Physical Cluster #k
Sync
Phy Add
User Data
Parity
Sync
Phy Add
User Data
Parity
Physical Cluster #k+1
9B
9B
Case 3
AUN #k
AUN #k+1
Physical Cluster #k
Sync
Phy Add
User Data
Parity
Sync
Phy Add
User Data
Parity
Physical Cluster #k+1
9B
9B

FIG. 10B

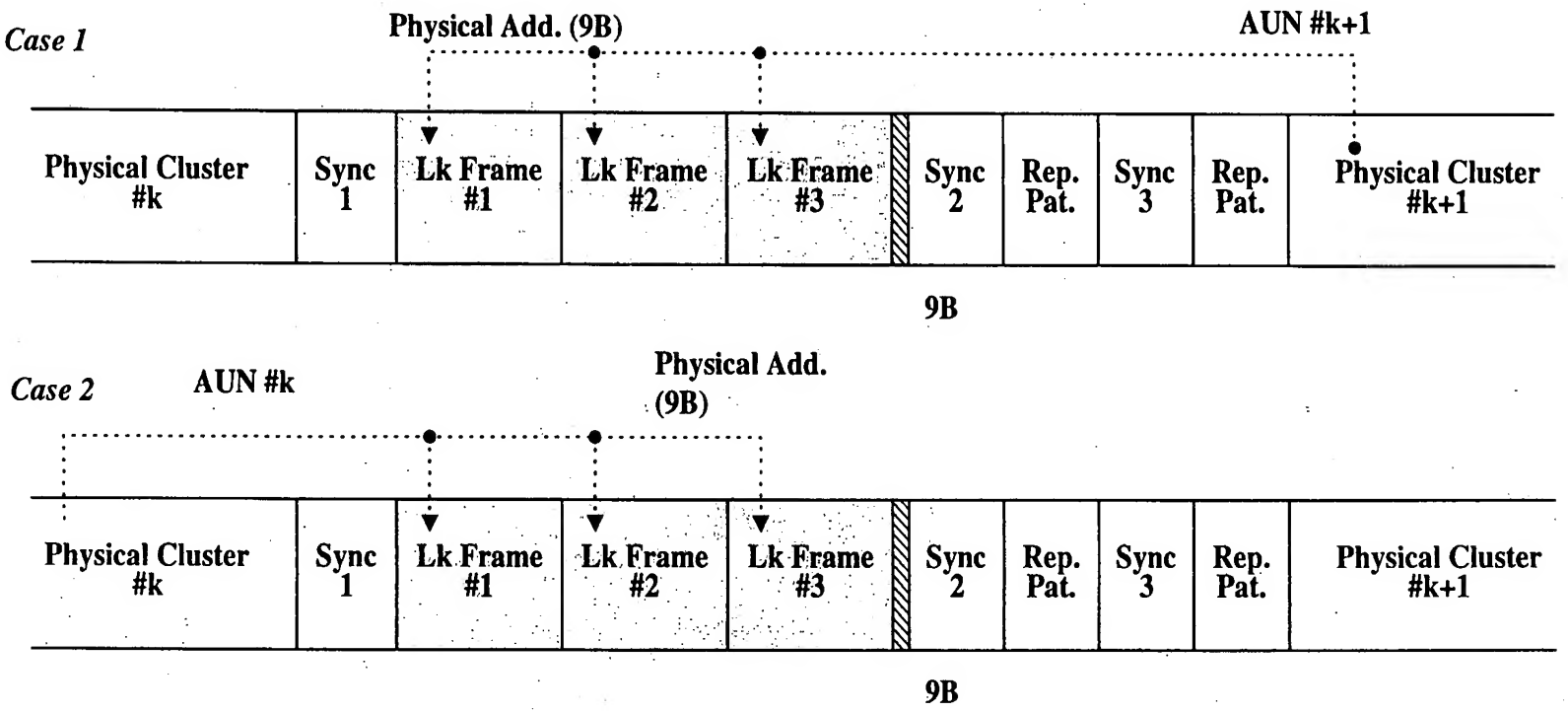

Case 1
Physical Add. (9B)
AUN #k+1
Physical Cluster #k
Sync 1
Lk Frame #1
Lk Frame #2
Lk Frame #3
Sync 2
Rep. Pat.
Sync 3
Rep. Pat.
Physical Cluster #k+1
9B
Case 2
AUN #k
Physical Add. (9B)
Physical Cluster #k
Sync 1
Lk Frame #1
Lk Frame #2
Lk Frame #3
Sync 2
Rep. Pat.
Sync 3
Rep. Pat.
Physical Cluster #k+1
9B

FIG. 10C

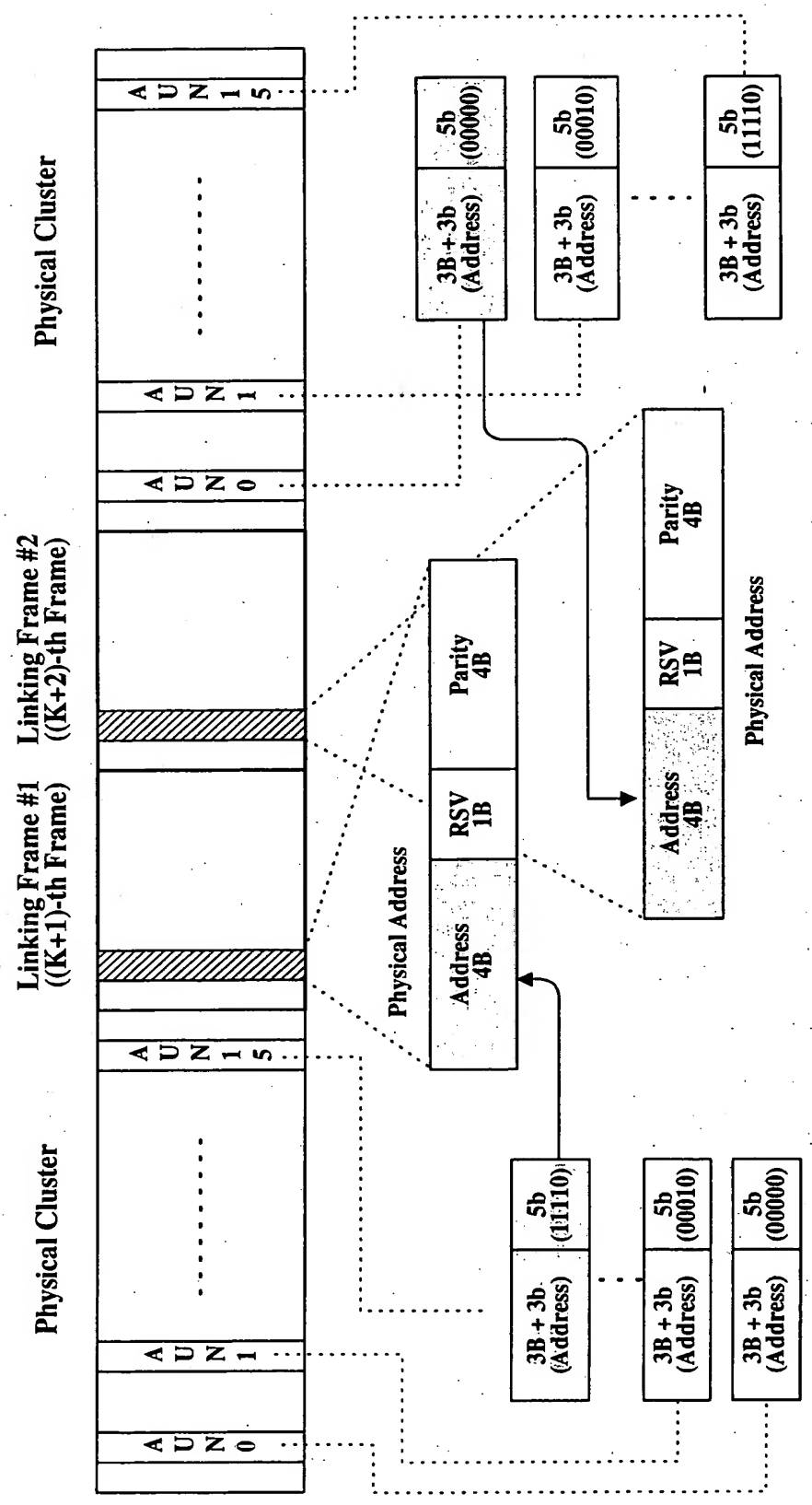

Physical Cluster
Linking Frame #1 ((K+1)-th Frame)
Linking Frame #2 ((K+2)-th Frame)
Physical Cluster
AUN 0
AUN 1
AUN 15
Physical Address
Address 4B
RSV 1B
Parity 4B
3B + 3b (Address)
5b (11110)
5b (00010)
5b (00000)
Physical Address
Address 4B
RSV 1B
Parity 4B
3B + 3b (Address)
5b (00000)
5b (00010)
5b (11110)

FIG. 11A

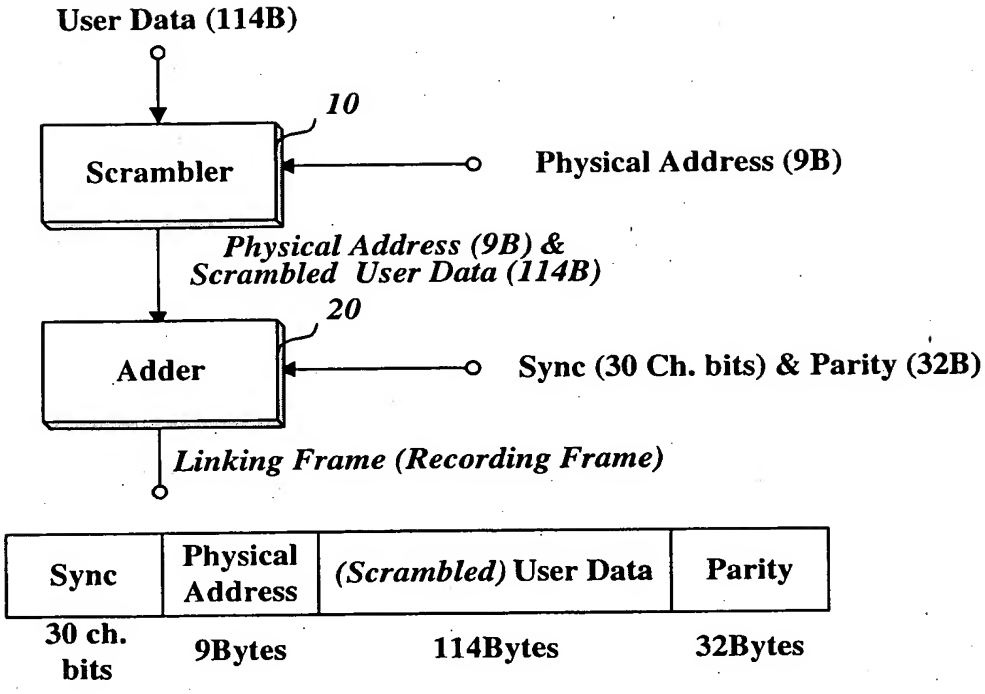


FIG. 11B

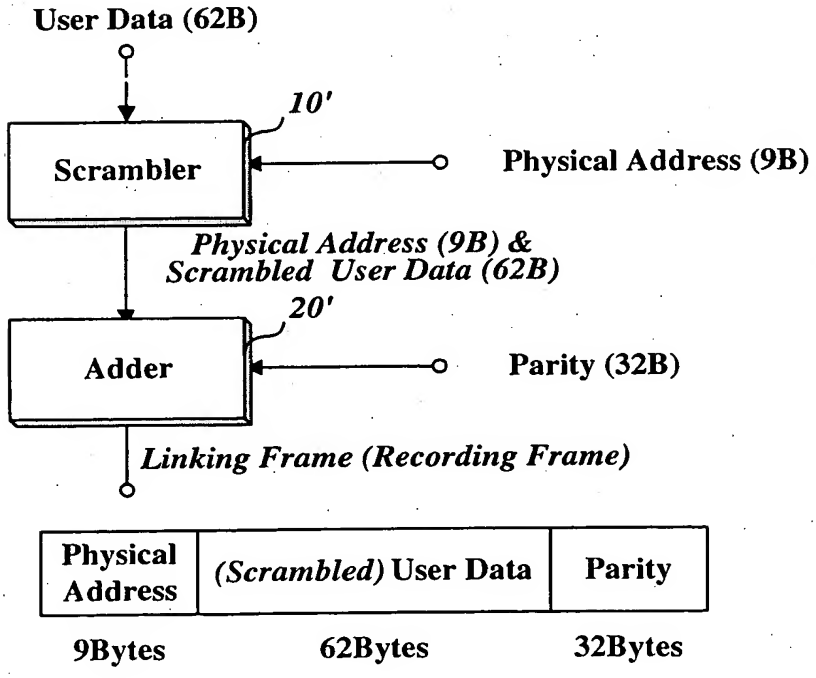


FIG. 12A

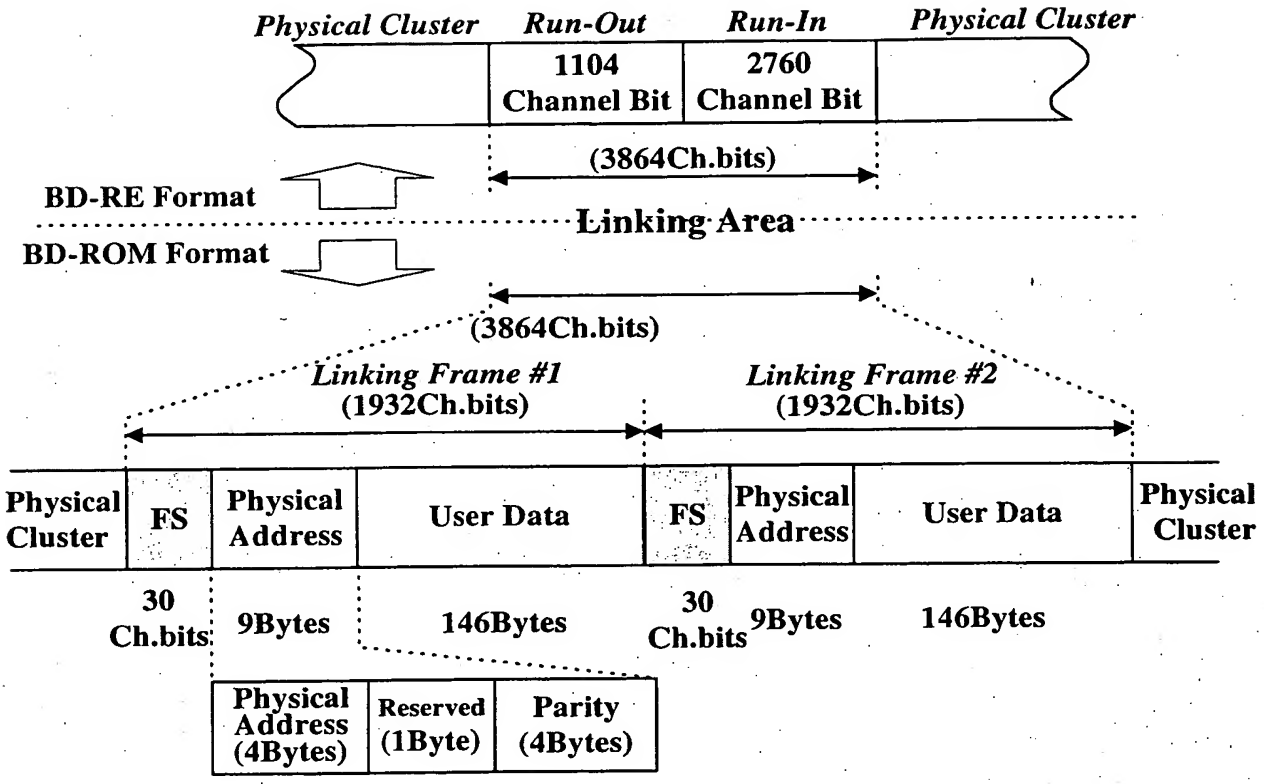

Physical Cluster
Run-Out
Run-In
Physical Cluster
1104 Channel Bit
2760 Channel Bit
(3864Ch.bits)
BD-RE Format
Linking Area
BD-ROM Format
(3864Ch.bits)
Linking Frame #1 (1932Ch.bits)
Linking Frame #2 (1932Ch.bits)
Physical Cluster
FS
Physical Address
User Data
FS
Physical Address
User Data
Physical Cluster
30 Ch.bits
9Bytes
146Bytes
30 Ch.bits
9Bytes
146Bytes
Physical Address (4Bytes)
Reserved (1Byte)
Parity (4Bytes)

FIG. 12B

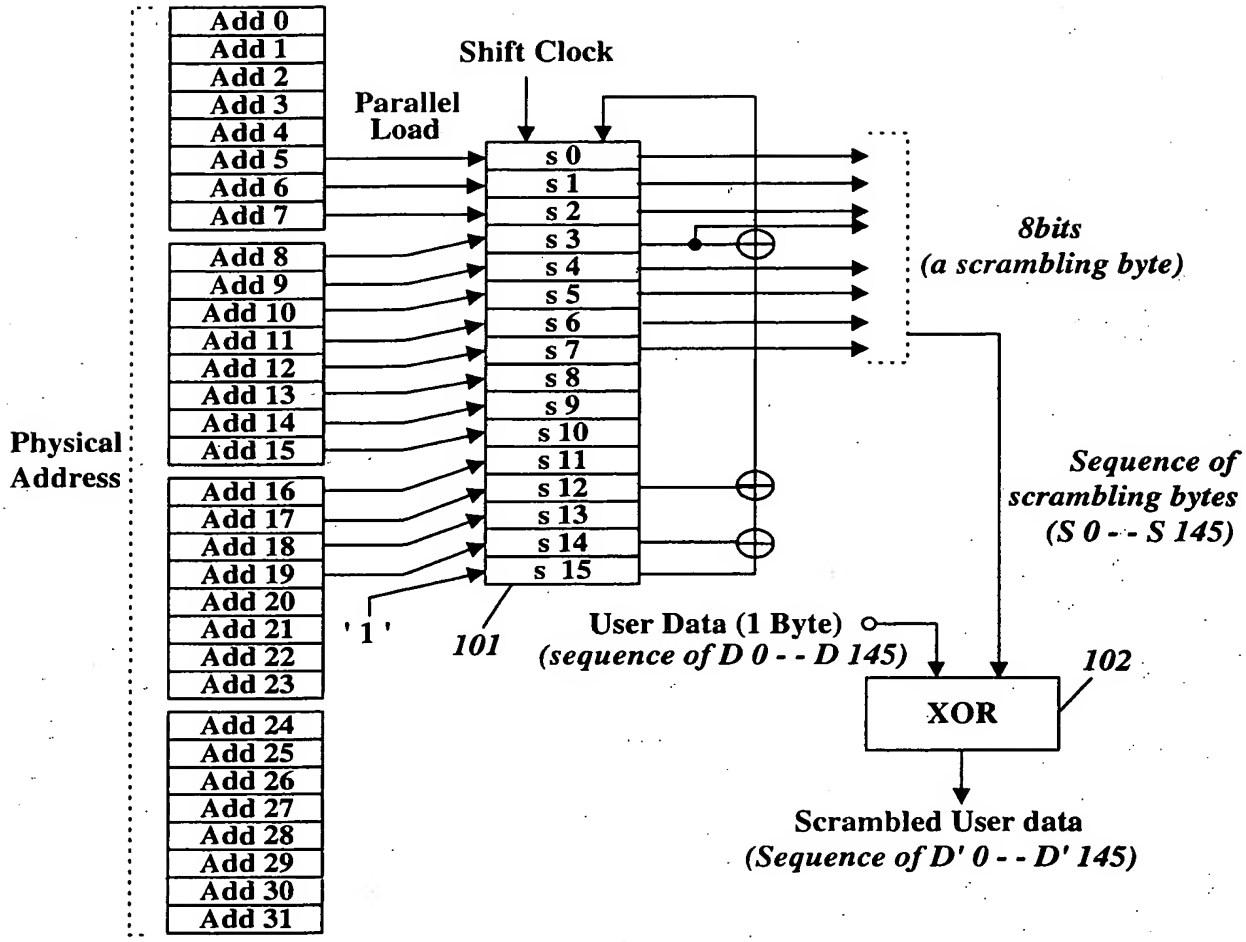

Add 0
Add 1
Add 2
Add 3
Add 4
Add 5
Add 6
Add 7
Add 8
Add 9
Add 10
Add 11
Add 12
Add 13
Add 14
Add 15
Add 16
Add 17
Add 18
Add 19
Add 20
Add 21
Add 22
Add 23
Add 24
Add 25
Add 26
Add 27
Add 28
Add 29
Add 30
Add 31
Physical Address
Shift Clock
Parallel Load
s 0
s 1
s 2
s 3
s 4
s 5
s 6
s 7
s 8
s 9
s 10
s 11
s 12
s 13
s 14
s 15
'1'
101
8bits
(a scrambling byte)
Sequence of scrambling bytes
(S 0 - - S 145)
User Data (1 Byte)
(sequence of D 0 - - D 145)
102
XOR
Scrambled User data
(Sequence of D' 0 - - D' 145)

FIG. 13

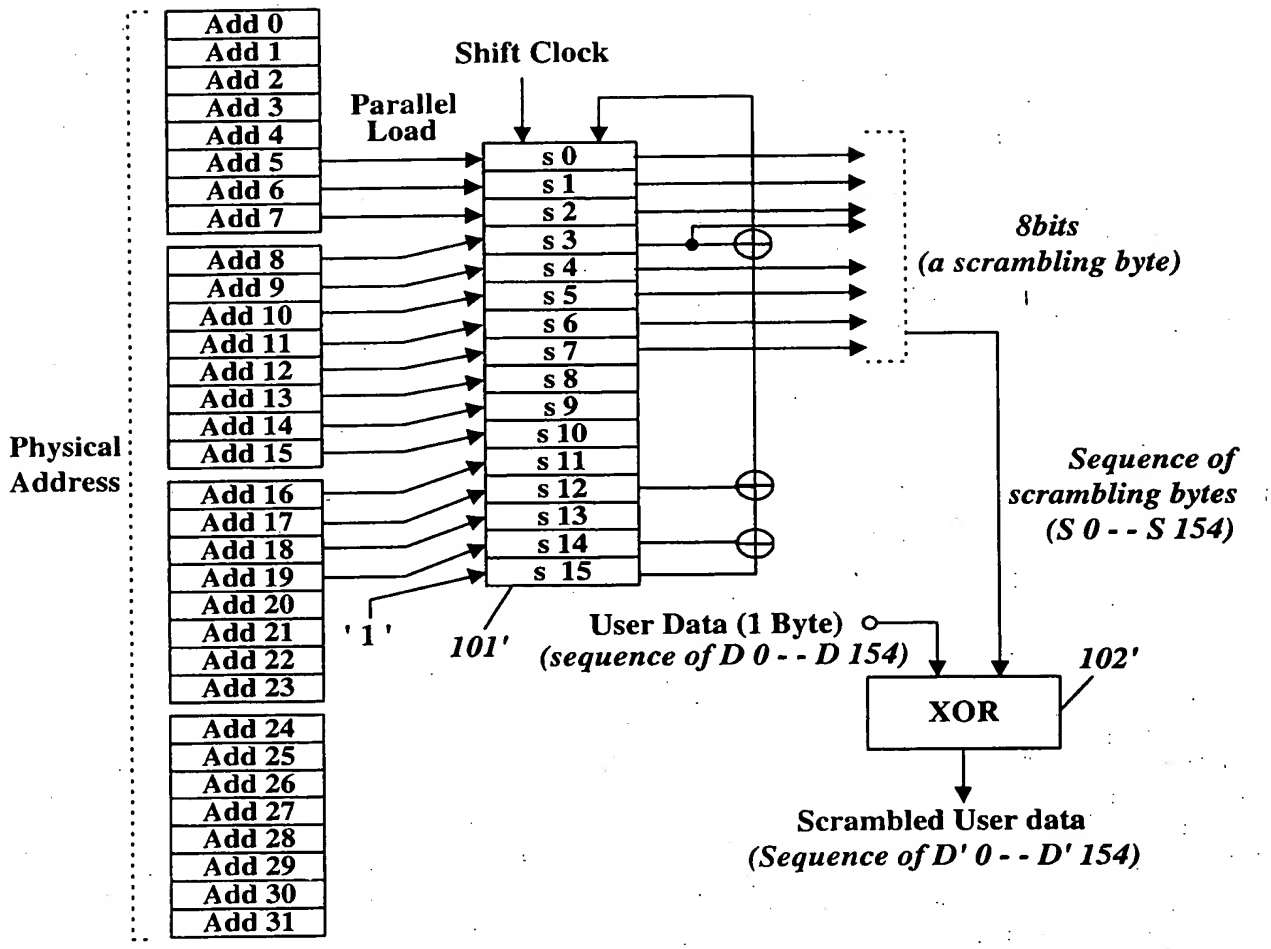

Add 0
Add 1
Add 2
Add 3
Add 4
Add 5
Add 6
Add 7
Add 8
Add 9
Add 10
Add 11
Add 12
Add 13
Add 14
Add 15
Add 16
Add 17
Add 18
Add 19
Add 20
Add 21
Add 22
Add 23
Add 24
Add 25
Add 26
Add 27
Add 28
Add 29
Add 30
Add 31
Physical Address
Shift Clock
Parallel Load
s 0
s 1
s 2
s 3
s 4
s 5
s 6
s 7
s 8
s 9
s 10
s 11
s 12
s 13
s 14
s 15
' 1 '
101'
8bits
(a scrambling byte)
Sequence of scrambling bytes
(S 0 - - S 154)
User Data (1 Byte)
(sequence of D 0 - - D 154)
102'
XOR
Scrambled User data
(Sequence of D' 0 - - D' 154)

FIG. 14A

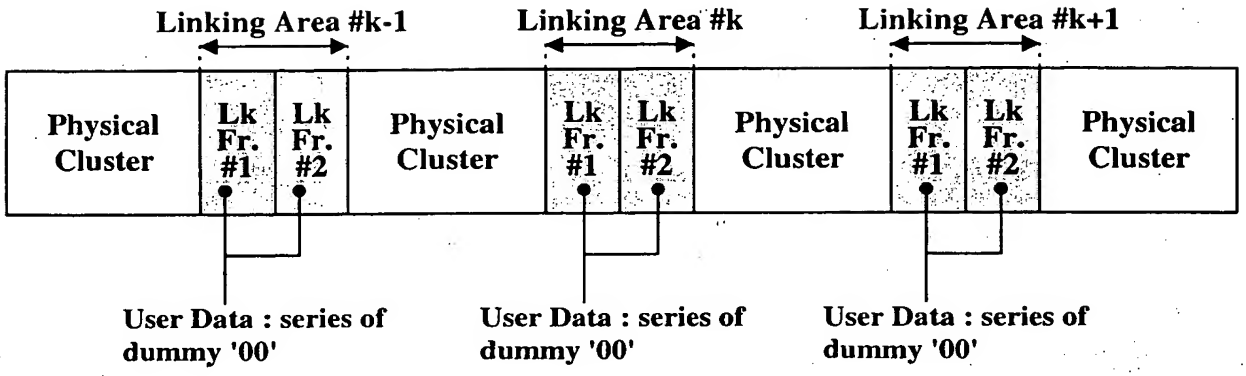


FIG. 14B

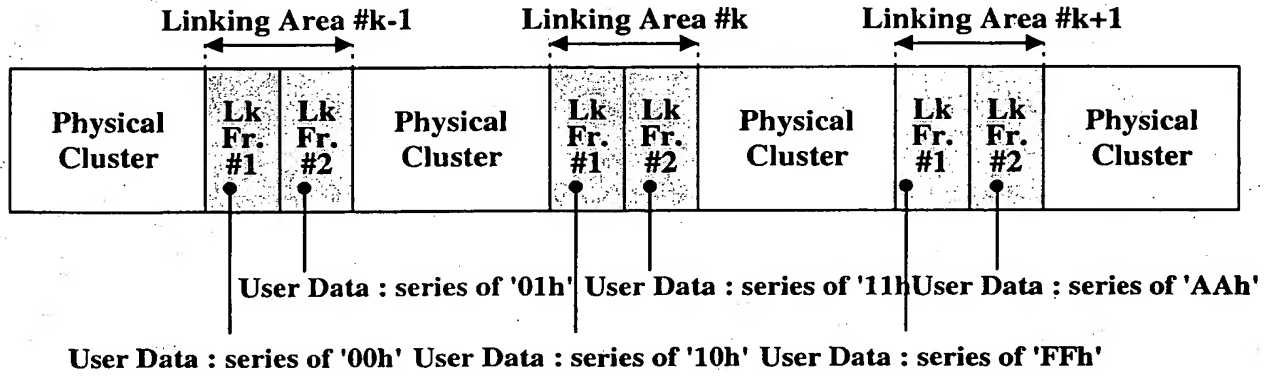


FIG. 14C

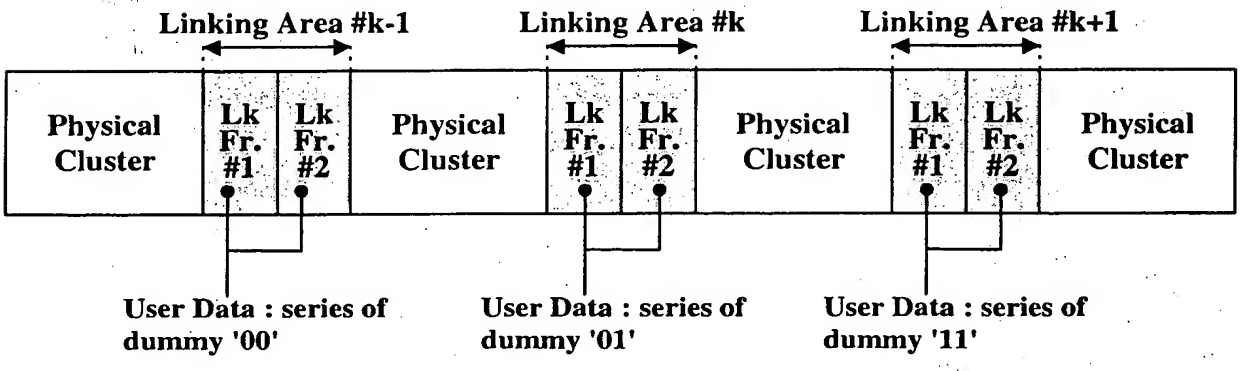


FIG. 15A

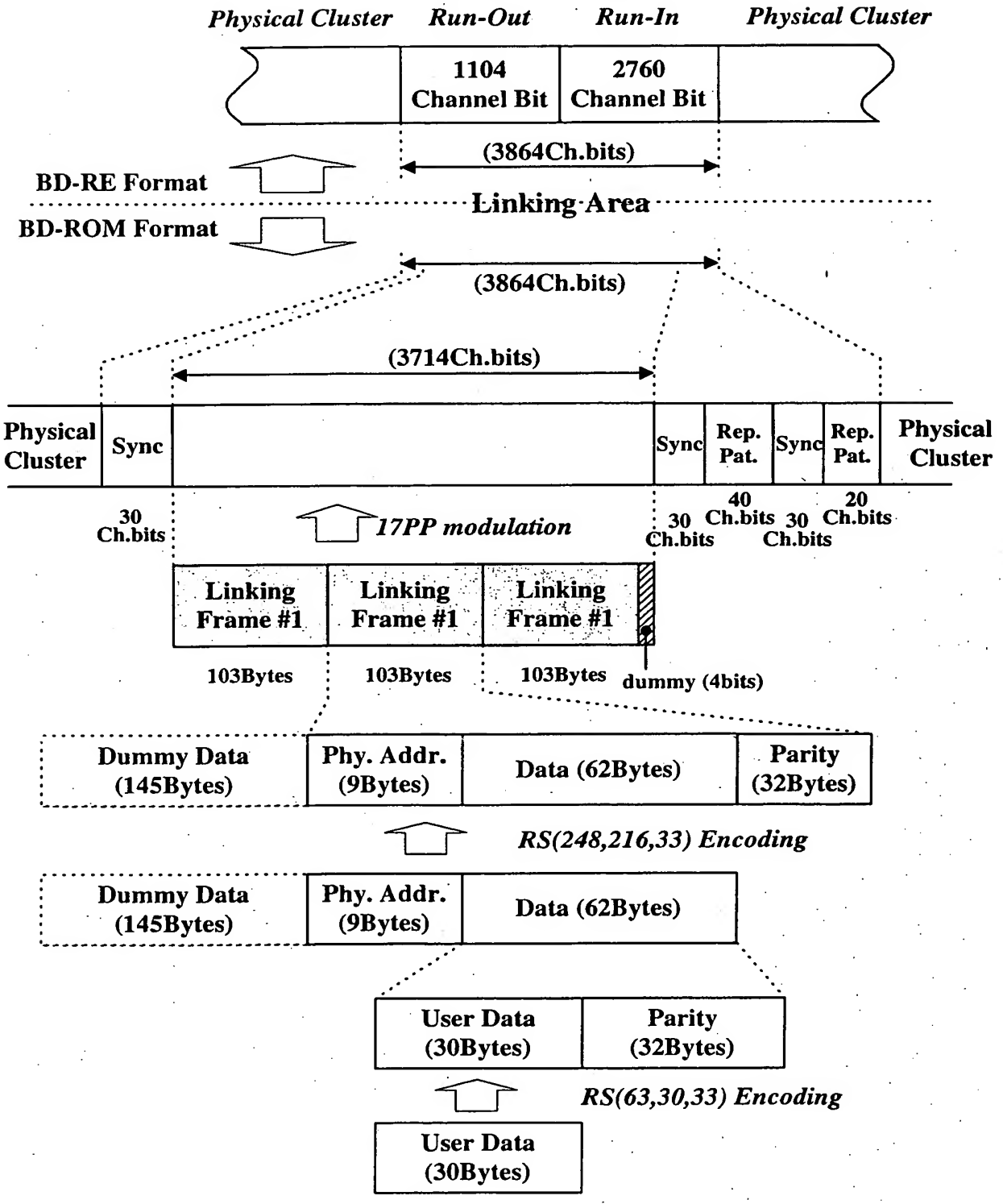

Physical Cluster
Run-Out
Run-In
Physical Cluster
1104 Channel Bit
2760 Channel Bit
(3864Ch.bits)
BD-RE Format
Linking Area
BD-ROM Format
(3864Ch.bits)
(3714Ch.bits)
Physical Cluster
Sync
Sync
Rep. Pat.
Sync
Rep. Pat.
Physical Cluster
30 Ch.bits
17PP modulation
30 Ch.bits
40 Ch.bits
30 Ch.bits
20 Ch.bits
Linking Frame #1
Linking Frame #1
Linking Frame #1
103Bytes
103Bytes
103Bytes
dummy (4bits)
Dummy Data (145Bytes)
Phy. Addr. (9Bytes)
Data (62Bytes)
Parity (32Bytes)
RS(248,216,33) Encoding
Dummy Data (145Bytes)
Phy. Addr. (9Bytes)
Data (62Bytes)
User Data (30Bytes)
Parity (32Bytes)
RS(63,30,33) Encoding
User Data (30Bytes)

FIG. 15B

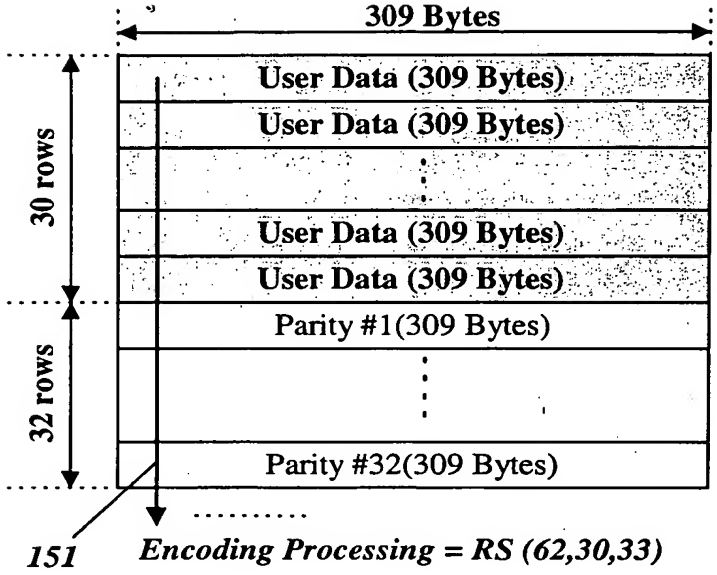


FIG. 15C

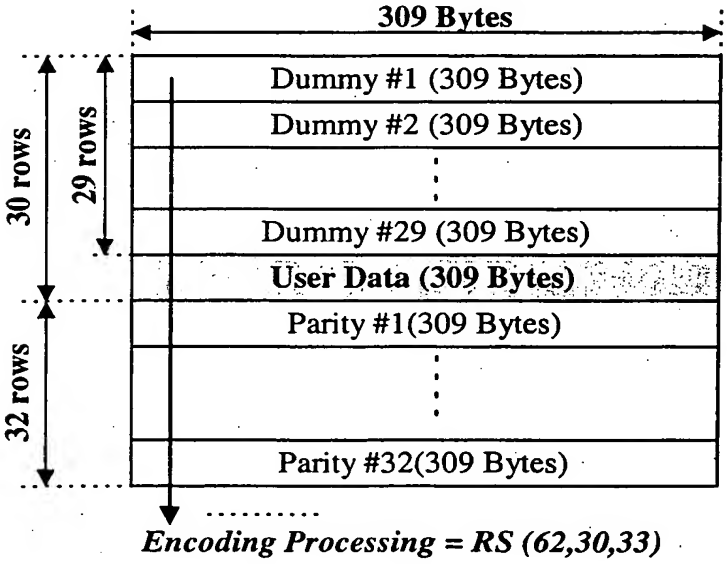
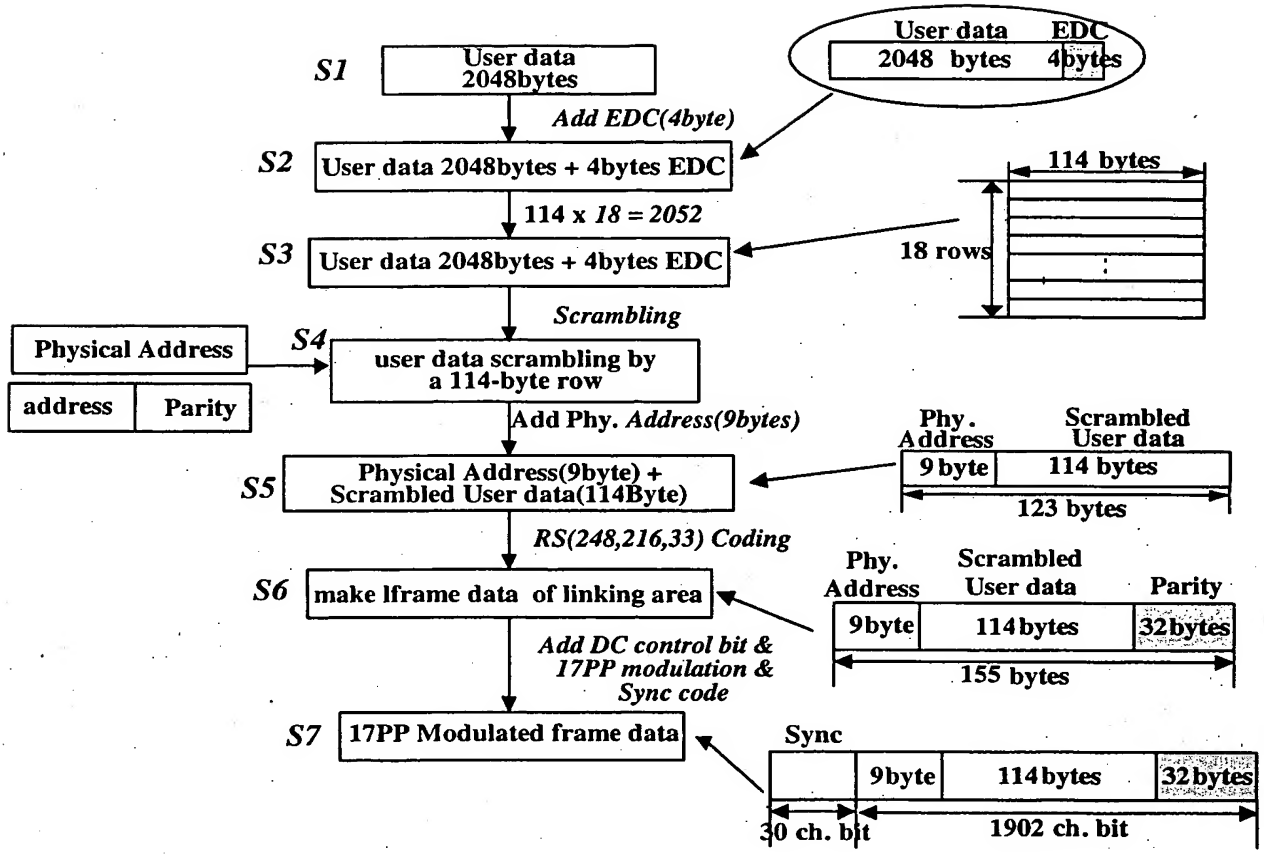


FIG. 16


S1
User data 2048bytes
Add EDC(4byte)
S2
User data 2048bytes + 4bytes EDC
114 x 18 = 2052
S3
User data 2048bytes + 4bytes EDC
Scrambling
S4
user data scrambling by a 114-byte row
Add Phy. Address(9bytes)
S5
Physical Address(9byte) + Scrambled User data(114Byte)
RS(248,216,33) Coding
S6
make Iframe data of linking area
Add DC control bit & 17PP modulation & Sync code
S7
17PP Modulated frame data
User data
EDC
2048 bytes
4bytes
114 bytes
18 rows
Physical Address
address
Parity
Phy. Address
Scrambled User data
9 byte
114 bytes
123 bytes
Phy. Address
Scrambled User data
Parity
9byte
114bytes
32bytes
155 bytes
Sync
9byte
114bytes
32bytes
30 ch. bit
1902 ch. bit